Participatory research and extension approaches

J. Ellis-Jones, S. Schulz, D. Chikoye, N. de Haan, P. Kormawa, and D. Adedzwa

Research Guide

71

International Institute of Tropical Agriculture IITA

Information Services and Training
IITA, Oyo Road, PMB 5320, Ibadan, Nigeria
Tel: (+234 2) 241 2626
Fax: (+234 2) 241 2221
E-mail: iita@cgiar.org
Web: www.cgiar.org/iita

International mailing address:
c/o L.W. Lambourn & Co., Carolyn House, 26 Dingwall Road
Croydon CR9 3EE, UK

Printed in Nigeria by IITA

ISBN 978-131-247-5

Correct citation:

Ellis-Jones, J., S. Schulz, D. Chikoye, N. de Haan, P. Kormawa, and D. Adedzwa. 2005. Participatory research and extension approaches: a guide for researchers and extension workers for involving farmers in research and development. International Institute for Tropical Agriculture, Ibadan, Nigeria and Silsoe Research Institute, UK. 52p.

IRG 71

Participatory research and extension approaches

Ellis-Jones, J., S. Schulz, D. Chikoye, N. de Haan, P. Kormawa, and D. Adedzwa

Acknowledgements

The International Institute of Tropical Agriculture staff in particular, A.G. Azeez, Sadiq Bako, John Dada, Alphonse Emechebe, Linus Franke, Simon Ibana, Ole Nielsen, Segun Oguntoyinbo, Tunji Olanrewaju, Odunayo Oyederu, Lekan Tobe, Gbassey Tarawali, and Udensi Udensi.

The Federal University of Agriculture, Makurdi, Cooperative Extension Center staff who facilitated discussions with local communities, using the participatory tools discussed in the Guide, in particular, Mary Agada, Terlumun Avav, Roseline Daudu, Chris Ekong, Mike Ijoyah, Emmanuel Odiaka, Andrew Ogwuche, Eunice Okoroafor, John Ortese, Josephine Ayoola, and Stella Saror.

Ahmadu Bello University (Institute for Agricultural Research), Zaria, in particular, Muhammed A. Hussaini, Ibrahim Kureh, A. Odunze, J. Onyibe, A. Sani, and Joseph Shebayan.

State, Local Government and NGO extension staff in Cross River, Kaduna, Benue, and Kogi states in particular, extension supervisors, Gregory Adung, Clement Agada, Abdul Danbaba, Sanni Isa, Joseph Odey, Zakari Yakubu, and I. Zango.

Individual farmers and communities in Benue, Cross River, Kaduna, and Kogi states who participated in the program and provided valuable insight on how to best work with, learn from, and facilitate new activities in their areas.

The Guide is a product of a project funded by the UK Department for International Development (DFID) (R7864c). The views expressed are not necessarily those of DFID.

Contents

Objectives

This guide is intended to enable you to:

- Outline an approach that will facilitate rural community, group and individual farmer involvement in a participatory research and development process. Sometimes this may be called a participatory extension approach or a participatory learning and action research, or participatory technology development.
- Reinforce changes in moving from traditional to participatory research and development.
- Describe with practical examples a process using participatory tools, which can be used for promoting participatory research and development activities in agriculture.

1 Introduction

This Guide is a product of a project entitled "Realizing sustainable weed management to reduce poverty and drudgery amongst small-scale farmers in the West African savanna". It is concerned with continuous cultivation of the moist savanna with inadequate inputs resulting in declining crop yields and increasing rural poverty. *Striga* and *Imperata* were considered to be major contributory problems. At the same time, it had been realized that adoption of promising control methods such as cover and trap crops, improved crop agronomy, chemical control and the use of resistant crop varieties had been inconsistent, with overall adoption being much less than expected. The Guide aims to pass on experiences on use of participatory methodologies gained through work on this project over the past three years.

Following two stakeholder workshops, one for *Striga* and the other for *Imperata*, a participatory research and development process was initiated in Kaduna (for *Striga*), Benue, Cross River, and Kogi (for *Imperata*) states. Training in participatory research and extension approaches (PREA), *Striga* and *Imperata* management for over 100 government and NGO extension agents laid the foundation for farmer led testing of appropriate technologies. As a result, *Striga* trials were undertaken and evaluated by over 600 farmers and *Imperata* trials by over 1000 farmers, facilitated by both research and extension agents. The development and use of extension materials and training for lead farmers has greatly assisted the process. As a result of increased productivity and increased farmer-to-farmer extension motivated by extension agents, the use of the technologies has spread and many stakeholders have become involved in the process. This has led to an increased understanding of the processes by which technologies are assimilated into farmers' management practices and extension effort being more attuned to farmers needs.

This Guide describes the processes used in the project, which can be adapted for use in other research for development initiatives.

2 The evolution of participatory methods

Until recently, development in rural Africa often consisted of farmers and communities being told what to do. Often when governments imposed their concepts of good land husbandry, this was characterized by issuing instructions, checking whether farmers followed these instructions and sometimes even imposing fines or imprisonment if they did not. The research and development process changed from the 1950s to the present (Table 1).

Table 1. Research and development trends (1950 to present).

Period	Explanation for non adoption	Prescription	Activity	Research methods
1950–1960s	Ignorance	Research	Transfer technology	Commodity research
1970–1980s	Farm-level constraints	Remove constraints	T&V Supply inputs	Constraints analysis Farming systems research
1990–2000s	Technology does not fit	Change process Provide options	Facilitating farmer participation	Enhancing farmer competence Changing professional behavior

Source: Adapted from Chambers (1993)

During the 1950s and 1960s, the underlying concept was that scientific knowledge was superior to farmers' knowledge. Farmers were encouraged to adopt new technologies because scientists developed them. Those who adopted were seen as innovators and those who did not, were seen as laggards. The extension agents' job was to convince farmers of the potentials of the new technology.

By the 1970s, criticism of this approach was based on the lack of adoption by farmers. Critics saw it as top-down, context-less, and solely scientifically-based. In reaction, scientists re-examined the technologies to figure out where the technology went wrong. As a result, farming systems research became increasingly important. This focused on understanding and improving existing systems rather than on their wholesale replacement. It was considered essential to base technical change on an understanding of how farmers perceived and managed their farming systems with development activities being centered on ensuring farmers had access to inputs. This resulted in increased emphasis on on-farm trials and on technology development under more realistic conditions with farmers being part of the technology. Though this approach gave more credence to the farmer, farmers' input was still limited to helping to identify the problem. Whilst much of the philosophy of this approach remains relevant, in practice, it has been high-cost, often with an inability to scale-up recommendations, and sometimes, resistance from researchers, who do not want to be drawn out of conventional modes of operation.

During the same period, training and visit (T&V) extension systems were being promoted in many countries. They ensured that field staff concentrated on extension without having the burden of other activities such as administering subsidy schemes or distributing inputs. Nevertheless, T&V still retained a strongly hierarchical structure with village-level extension workers backed by subject matter specialists relying on strong technical messages reminiscent of technology transfer. As a result, T&V systems became both costly and often nonfunctional.

With the demise of T&V in the 1990s, priority shifted to encouraging increased community and farmer participation in identifying problems and solutions in an equal partnership with researchers and extension workers. In the process of accepting the farmer as a participant, it became clear that farmers were also experimenting and adapting technologies to their own situations. Science was no longer seen as a privileged knowledge set, but simply one of the options from which people could choose. As a result, emphasis moved towards finding solutions that started with the community, through negotiation between farmer and scientist. Unfortunately, despite growing recognition of the potential for farmer participation, many institutions and individuals still choose to apply approaches dominated by narrow technical and economic perspectives.

Rejecting a scientific one-on-one approach to technology transfer implies that changes need to be made during project implementation. Communities and the networks to which people belong play a more important role in influencing agricultural practices. It is therefore necessary to examine these and, where possible, incorporate them into a technology development process. Because knowledge, context, and networks are considered important, development itself is changing.

In the past, development meant having technologies adopted or adapted by farmers. It has been increasingly realized that new technology alone is insufficient for achieving impact. As a result, many research organizations have moved from a primary focus on productivity to include concerns about the environment, poverty, and food and financial security, reflecting a growing understanding that securing food, eradicating poverty, and protecting natural resources are inseparable goals (PRGA 2000). Many organizations are now developing ways to involve farmers in processes for generating economically and environmentally sound technologies that are more sustainable and provide more equitable use of natural resources. The awareness of farmers' roles as resource managers is increasing and natural resource management goes beyond merely consulting with farmers to sharing decision-making and responsibility for outcomes from management choices and decisions.

Farmer groups are ideal for encouraging farmer involvement and for sharing knowledge at the local level as they allow farmers to use the networks that they have, use the group to build up new networks, and to negotiate the technology that fits within their own life. Farmer-to-farmer extension is premised on the belief that for a farmer, "seeing is believing" and other farmers are the best educators. Through discussions with other farmers and groups, they will be stimulated to try out new technologies.

3 The process of participatory research and extension

Farmers' involvement as decision-makers rather than research subjects or passive components of the farming system under investigation is central to farmer participatory research and has led to the boundaries between research and development becoming increasingly blurred. Unfortunately, the literature abounds with inconsistent and often confusing jargon, which has given rise to a number of similar approaches. These are often different in name only and have a great deal in common. These include:

- Participatory development (or extension) approaches.
- Participatory research approaches.
- Participatory learning and action research.
- Participatory research and extension.
- Participatory technology development.

Underlying all of these is the acceptance of the central role that farmers could and should play, if given opportunity, in both research and development. Particular emphasis is placed on their participation throughout a process of situation analysis, needs and opportunity assessment, setting of research and development objectives, setting of indicators, planning and implementation, and monitoring and evaluation of results. In this way farmers can also play a key role in the diffusion of research findings.

Participatory research and development can be seen as a continuous process, starting with different stakeholders (researchers, extension agents, farmers, and commercial organizations) sharing experiences, pulling their knowledge and resources and planning together. This requires commitment and agreement by each stakeholder to follow-up on what was agreed during discussions. Too often researchers use participatory methods for extracting information without commitment to the underlying principle of acting together. Close association and coordination are likely to promote adoption and further adaptation, leading to wider scaling-up and improved livelihoods.

Some key basic principles are involved during this participatory process (Box 1). This in turn needs improved communication skills (Box 2) that require research and development staff to act as facilitators, not teachers (Box 3).

Box 1. Some basic principles involved with participatory processes.

- Learn from different stakeholders and involve them in all stages of the process. Value their knowledge and skills.
- Do not waste peoples' time in obtaining an excess of detailed information, which will waste time and hide important issues. Qualitative information is often more useful than elaborate statistics obtained through time-consuming questionnaires.
- Ensure that the least articulate people, often women, and marginalized members of the community are able to contribute and to benefit.
- Cross check information by asking different people and use different participatory tools to cover the same issue.
- Link research with development action.
- Local communities must make as many as possible of the decisions involved.
- The process should be gender-sensitive. Women are often disadvantaged and this imbalance needs to be recognized and initiatives that reduce this inequality encouraged.
- The use of participatory tools should not be seen as "an end in itself" but should always lead to concrete activities implemented in the community. It should be seen as finding solutions together for the community.
- Activities should be sustainable and continue after outside support has ceased.

Box 2. Communication and facilitation skills.

A facilitator's task is to inform, promote, assist, support, help, and monitor.

To fulfil this task, the key is to improve communication skills. Communication is both verbal and nonverbal through body language.

Body language. This refers to the way in which we behave, the messages given by our bodies, when we interact with others. Good body language is important in ensuring successful communication. When a facilitator sits on a chair when others are sitting on the ground, he establishes a relationship of authority rather than equality; he shows disrespect and can frighten people with his large record book and smart clothes. To improve on this situation, it is important to show respect and interest. By sitting at the same level and forming a circle, it is easier to establish a relationship of equality and trust.

Verbal communication. What we say and how we say it can hamper or facilitate communication. Giving orders, threatening, moralizing, criticizing, and giving advice are all communication blocks. On the other hand, there are communication aids, which help to create a climate of confidence. Passive listening (letting others talk), giving acknowledgements, door openers, and paraphrasing can improve communication.

Use diagrams, **symbols**, and **drawings**. Participatory techniques involve lots of drawing, because they are excellent communication aids, helping to involve others in discussion.

Box 3. Facilitator's main tasks and responsibilities.

- Assist local communities in analysing their situation and their problems, in finding solutions.
- Assist communities and groups to implement, monitor, and evaluate their activities.
- Help local communities and groups to establish links with other groups and institutions that may be able to support them.

Good facilitators play a neutral role, do not dominate or allow others to dominate meetings, they encourage all to express their opinions, ensure meeting objectives are met and follow up actions are agreed by everyone. It is important that facilitators have the respect and trust of the community with which they are working.

The research and development process requires guiding and facilitating through four key stages (Hagmann et al. 1998; 1999). These are:

Stage 1. Encouraging and mobilizing communities to undertake their own situational analysis and start thinking about how they can deal with their own problems.

Stage 2. Action planning by the community, which helps in motivating people and giving opportunity to disadvantaged groups to express their views.

Stage 3. Implementation and farmer experimentation

Stage 4. Monitoring and evaluation through sharing experiences, self-evaluation and planning for the next season.

In each of these stages, several activities are required (Fig. 1). A clear timetable for these activities is also essential (such as that shown in Annex 1). Each stage and the activities required are discussed in detail in sections for each in this Guide.

A large number of participatory tools are available for assisting in collecting and analyzing local information and situations (Box 4). These should not be confused with the four-stage process of PREA. The tools allow facilitators and community group members to communicate effectively during the process. Their appropriate use allows the community to better understand itself and identify problems and potential solutions.

Different tools can be used in different circumstances, depending on the type and amount of information required. However, over-use can be time-consuming and it is highly unlikely that there will be time to use all of them. They should therefore be carefully selected and not just used because of availability or familiarity. Participatory tools are like a carpenters' toolbox. Certain tools can only be used for certain jobs and others have more than one use. It is important to plan carefully information collection and decide which tools to use (Box 5).

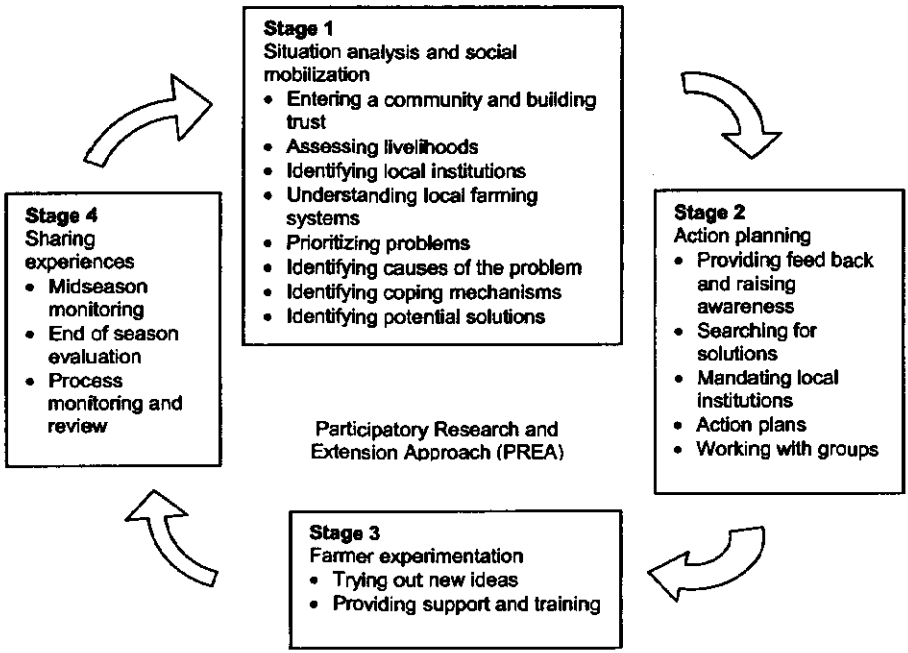


Figure 1. *Participatory research and extension approach.*

Box 4. Some key participatory tools.

- Livelihoods analysis
- Resource (or wealth) ranking
- Institutional analysis
- Seasonal calendars
- Gender analysis
- Flow diagrams
- Ranking techniques
  - Preference ranking
  - Pairwise ranking
  - Matrix ranking
- Causal diagrams
- Mapping
- Participatory budgeting

Examples of analysis using these tools are shown in Annexes 2–12.

Box 5. Some key principles in using participatory tools.

- Define the research objectives carefully.
- Define the topics, which need analysis.
- Identify the key areas of the research.
- Identify the sources of information for each topic area.
- Select the research tools, which are appropriate for each topic.
- Adapt these tools if necessary.
- Prepare the practical and logistical aspects carefully. Make appointments, gather existing research material to avoid repeating work that may have been undertaken.
- Arrive on time for meetings.
- Where practical, have a trial run with colleagues.
- Introduce yourself to local communities and leaders.
- Be aware of and comply with local customs and protocol.
- Make sure you follow the basic participatory principles, and use appropriate facilitation and communication skills.
- Be flexible, listen, and be prepared to change the approach.

4 Participatory research and extension in practice

Stage 1. Situation analysis and social mobilization

Entering a community and building trust. If a research and development activity is to be owned by a community, two key conditions need to be in place:

- Real motivation and enthusiasm within the community to resolve their problems, and
- Effective community institutions to support the process and take it forward.

Without these, there is little chance that development will be sustained without continuous external support. To motivate people, it is necessary to identify and address their key concerns. Only people themselves can effectively identify, clarify, and prioritize these concerns and find solutions. It is important to understand that a community is not homogenous and consists of different types of households and institutions with different roles and responsibilities. Local institutions may well have their own deficiencies but a key step in the process is identifying those that can take a lead in promoting the development process and building their capacity to develop and implement action plans responding to local communities' priorities.

The first step is for the research or extension agents to meet, discuss, and agree with as many of the community local leaders as possible the participatory approach to be taken and to gain their support for the process. This is likely to involve group and individual discussions.

Such meetings are intended to provide information about:

- The community, on how local people derive their livelihoods (meet their household needs and earn a living), the different types of households in the community based on wealth or access to resources, local institutions, and the crops that people grow and livestock they keep, and
- Natural resource problems with which they are faced (and their prioritization), existing coping mechanisms and institutions within the community who might have an interest in the priority problems.

Participants at such meetings should include community leaders, men, women, and young people. After initial introductions where the purpose and format of the meeting are agreed, group discussion to identify any differences in perceptions, followed by feedback and further discussion during a plenary discussion provides an appropriate and timesaving process (Box 6).

It is important to select times when people are not busy, such as planting and harvesting time, avoiding market days and other times when the community has other priorities. Also keep an eye on when would be convenient for women so that they can attend the meeting.

Box 6. Typical program for a community situation analysis and action-planning meeting.

Day 1

Plenary discussion: Introductions and agreement of the purpose and structure of the meeting.

- Group discussions
- Livelihoods
- Resource ranking
- Identification of local institutions*
- Crop prioritization
- Problem identification and prioritization*

Plenary report back from each group.

Day 2

Group discussions

- Identifying root causes of the problem
- Mapping the problem
- Establishing existing coping mechanisms*

Plenary session: providing feedback and raising awareness.

Day 3

Searching for solutions and selecting options for testing*

- Mandating local institutions*
- Planning action*

*These are regarded as the key sessions for less experienced facilitators.

Arrange discussions over a number of days, taking not more than 3–4 hours in each day, starting each day by recapping what was said and agreed on the previous days.

It is also important to ensure that whoever calls the meeting is respected by all, so that, for example, you do not get only his/her friends at the meeting.

Below is an explanation of the components that make up the situational analysis.

Assessing livelihoods. Livelihood analysis provides a better understanding of the different ways in which households derive a living; the numbers or percentage involved in the community; who in the community is involved; the relative importance of each in providing either food or cash; and the trends over the years and reasons for these trends. This helps to identify the most important livelihood activities and highlights any concerns that people may have in any of these activities.

An example is shown in Annex 2.

Identifying households' differences. In any community, there are differences in wealth, status, and access to resources. It is important to understand these differences and ensure that poor or marginalized people are involved in the development process. It is important to identify the criteria that local people use to determine differences (for instance, access to land, cattle, implements, housing, and number of wives).

A resource or wealth ranking exercise can provide the basis for a detailed assessment of the priority needs for different types of household in the community. If the needs of only articulate and better-off people are considered, others are likely to withdraw from the process. This can easily happen, if the community is regarded as a homogenous group of people. The initial resource ranking can serve as a reference for the monitoring and evaluation of the project at later stages.

An example of resource (or wealth ranking) is shown in Annex 3.

Identifying local institutions. Local institutions, rather than individuals acting on their own, should take forward any actions developed by the community. Such institutions can be those already existing or new ones formed especially for the task. However, the latter should be considered only if there are no suitable existing institutions. Most communities have local institutions such as a development council, farmers' association, or womens' or youth group. Experience

has shown that new institutions are often not sustainable and can be hampered by other community institutions that may feel that this is their responsibility. Strengthening an existing institution is a good means of developing local capacity. Undertaking an institutional analysis can identify local institutions.

An example of institutional analysis is shown in Annex 4.

Identifying and prioritizing crops and problems. A detailed analysis of farm activities will help to understand how the majority of rural communities survive. However, within a community meeting, it will be difficult and time-consuming to undertake a detailed farming systems analysis, although this can be initiated by asking a group of farmers to prepare a cropping or livestock production calendar (an example which is shown in Annex 6).

Initially, however, it may be better to identify the range of crops (and/or livestock) that people grow and prioritize these in order of importance for providing food security and cash from sales. Asking men, women, and younger people to undertake the activities separately should also identify gender and age perspectives. At the same time and within the same groups, people can be asked to identify and prioritize the main problems they have with their crops (or livestock).

Transect walks, mapping exercises, and historical time lines are other tools that can be used both to provide detailed information on the problem(s) and help in raising awareness.

At a later stage, a more complex flow analysis can be undertaken looking at the farm as a whole with inputs, outputs and the relationship between household supplied and purchased inputs such as seed, fertilizers, draft animals, and labor for each crop and livestock type. However, this is best undertaken on an individual household or small group basis, when it should be possible to compare the farming systems of better-off and poorer households. Such an analysis can help to further identify the main constraints within the community and those, which affect the poorest households the most.

Examples of crop priority preference ranking and problem priority pair-wise ranking are shown in Annexes 5 and 7.

Identifying root causes of problems. Using diagrams is a useful way to identify and analyze problems and their causes. This is especially important, as solutions can be based on addressing the causes. The priority problem is placed at the top of the diagram and by asking, "Why did this happen?" the root causes can be established. This helps to look at the interrelationships between contributory causes.

Causal diagramming works most effectively after farmers have discussed, listed, and prioritized their problems. Arrows can be used to represent the cause- and effect-relationships. Scoring helps to determine which causes are more important than others, adding to greater understanding and a more accurate picture of the scale of the problem. The scores do not give absolute values but help to prioritize the problem areas with respect to the impact that removing them is likely to have. They are, therefore, helpful in decision-making processes.

An example of a scored causal diagram is shown in Annex 8.

Mapping problems. Maps can provide an excellent way to understand local realities and how local people perceive them. They are an excellent communication aid, since all people, even those who have never been to school, can make and use maps. They promote participation and encourage active discussion about local resources, problems and opportunities. Once copied on a sheet of paper, a map can be used many times for discussion with farmers. It is important, however, that considerable thought is given to what needs to be mapped, as drawing can be time consuming. Typically, this may include homesteads, roads, rivers, and other key landmarks. Mapping *Striga* infestation within the arable areas gives an indication of the level of infestation.

Past, present, and future maps of *Striga* infestation, for example, can provide real motivation for future control activities. Older people can map *Striga*, as it may have existed 10–15 years ago, while more recent comers to the village can map present-day *Striga* infestation. This comparison can identify a trend allowing a future vision of *Striga* problems to be mapped in, say, another 10 years, if the weed is not controlled.

An example showing a time series of maps is shown in Annex 9.

Identifying existing coping mechanisms. In seeking how to resolve problems, people need to build on their own knowledge and existing control practices. This can help to build awareness and start to explore practical solutions to the identified problems. Identifying the following can do this:

- What methods do people know?
- Where did this knowledge come from?
- Who in the community are using these methods? Gender differentiation of who is responsible for deciding which methods are used and who does the work would also be appropriate.
- What are the advantages and disadvantages of each method?

- What are the trends in the use of such practices and the reasons for this?

An example of establishing existing coping strategies is shown in Annex 10.

Stage 2. Action planning by the community

Providing feedback and raising awareness. Whilst the findings from the situation analysis are important for outsiders to get to know the community, the results are even more important for the community themselves. Providing feedback provides an opportunity to raise awareness of the problems and their causes and reflect on possible solutions and those local institutions that can play a role. Feedback to the community will:

- Motivate people to become more involved in an action research and development process that can improve their livelihoods, and
- Give an opportunity for poorer and disadvantaged groups to express their views.

Many communities have become disempowered and/or demoralized by research and development programs, which have been brought to them in a top-down way, albeit with good intentions. For this reason, if the community is to participate effectively, they have to conceptualize their own problems and develop their own ways of dealing with them.

Once household and community issues have been explored, it is necessary to:

- Feedback to the rest of the community the issues and needs identified in the situation analysis.
- Analyze with the community the underlying causes of the problems identified and to identify possible solutions.
- Identify possible local institutions to help take forward some of these solutions.

Nominated members of each group providing the reports from their groups best achieve this in the community workshops. After this, it is important to:

- Agree on a schedule of work to be undertaken in addressing those needs.
- Agree on criteria and indicators, which enable the community to see whether their work is really leading to an improved situation.

Collective decision-making and local ownership are essential for success.

Searching for solutions. Once the root causes of the priority problems are known, it is easier to identify possible solutions. Fresh solutions to old problems need to be generated by blending suggestions from community members with those from people from outside the area. It is here that the roles of researcher and extension agents become increasingly important. The use of appropriate extension material will assist in creating a better understanding.

The search for solutions should focus initially on peoples' own knowledge. There may be traditional knowledge, which has been forgotten. This can be identified, perhaps from older members in the community and tried out again. However, the search is not limited to peoples' existing knowledge. They may have heard of solutions and ideas which other farmers practice or which researchers might know or bring to the area.

Options are for visits to innovative farmers, neighboring communities, or research stations, which are all likely to generate more ideas. This allows farmers to see first-hand how others have successfully dealt with problems. Such visits need to be planned and communities need to choose their own representatives, based on ability to report back so that everyone can benefit and not just the one who has travelled. Another approach is the use of a mother, daughter and granddaughter approach (sometimes called mother-baby trials) in the research process to raise awareness and encourage farmers to test those research options applicable to their own environments and management conditions (Table 2).

This approach was used successfully, where mother trials were established at the Institute for Agricultural Research in Zaria, providing useful scientific information on *Striga* control. Farmers and extension workers from adjoining areas visited these trials.

Table 2. Mother, daughter, and granddaughter trial characterization.

Trials	Type of research
Mother trials	
Includes all options selected by researchers with input from farmers	On-station, researcher-managed
Daughter trials	
Best-bet options and local innovations selected by farmers	On-farm researcher-managed with significant input from farmers and backstopping from extension agents
Granddaughter trials	
Options selected by farmers	On-farm farmer-managed with no input from researchers

They selected options they considered best for their circumstances and subsequently established daughter trials on their own farms. Mid- and end of season evaluations, involving many other farmers and facilitated by the extension agents, resulted in other farmers testing some of the technologies on their own; this was the granddaughter stage.

Mandating local institutions. Once possible solutions have been selected, the community needs to take actions forward through their local institutions. It must not be left for the extension worker or researcher to make decisions and become the driver and owner of the process instead of the community. There needs to be a consensus about which institutions are used. If a local institution is weak, options need to be agreed on how to strengthen it. If a new institution is created it should also be supported, for example by improving leadership and communication. If the leaders of the selected institution in the meeting agree to take responsibility in the presence of others, this helps to create commitment and accountability. At some later stage leadership and communication training should be provided for key community members.

Lead farmers and groups. One approach is to work with lead farmers, selected by the institutions they represent, to undertake the piloting and testing of new technologies. Regular feedback from the lead farmer to the group will ensure the group's involvement in planning, implementation, and encourage a process of further farmer-to-farmer testing, adaptation and diffusion. The responsibilities of lead farmers and the group also need to be agreed (Box 7).

Box 7. Potential roles and responsibilities of local institutions (groups) and lead farmers.

Potential role of local community institutions are to:

- Formerly adopt the program into their activities.
- Appoint persons responsible for reporting on progress and identifying issues/problems that affects the program. This is likely to be the lead farmer.
- Encourage participation by other farmers in trying the new techniques.
- Invite the extension agent to attend meetings on a regular basis.
- Arrange field days that cover all farmers.
- Evaluate the control methods at the end of the season and plan for the new season.

Potential responsibilities of lead farmers include:

- Motivating other farmers to try out new technologies.
- Assisting the project planning process using participatory methods.
- Assisting the extension agent in training the group and other farmers.
- Hosting mid and end of season evaluations of the test plots and demonstrations.
- Ensuring that information is disseminated to the community at large.
- Holding regular meetings with other farmers and present concerns to the group and extension agent.
- Facilitating coordination between the group and the extension agent.

The lead farmer needs to be a:

- *Group advisor*—helping to strengthen the group leadership, organizational and planning capacities.
- *Participatory trainer*—teaching group members basic technical skills through a farmer field school approach.
- *Link person*—facilitating communication between the group and the extension agent.

Action planning. After clarifying the possible solutions and institutional responsibilities, concrete actions need to be agreed and planned. This often takes place after a visit to another area or research station (the mother-daughter-granddaughter approach). The most promising options are selected, agreed, and a decision made on how and who should try them. A time plan of action needs to be agreed. At this stage, the community should be able to define the nature of support they expect from researchers or extension agents.

In some cases, potential solutions identified by the community can be standardized technology, where implementation is mainly linked to the organization of materials and labor. However, in most cases, potential solutions are not so clear and new ideas have to be tested and adapted to suit local conditions. It is important that offers of support from researchers, extension agents (EAs) or private companies are met and trust is maintained. This might include provision of new seed, credit or future visits.

Stage 3. Implementation and farmer experimentation

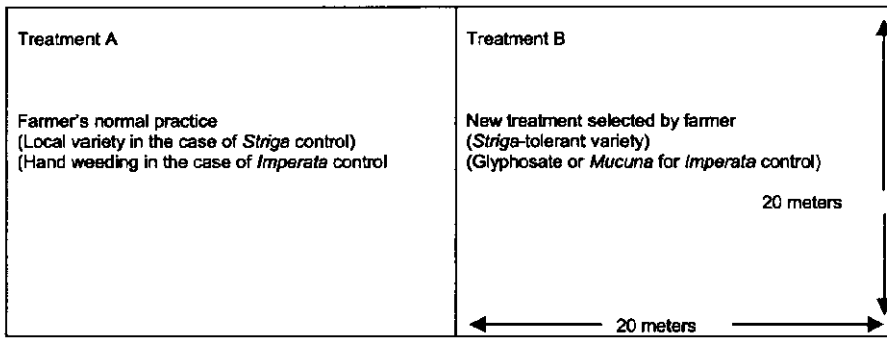
To see whether a new technique is better than the usual practice, a comparison is needed. An easy way of doing this is putting the two, side-by-side, in the same field, so that both areas are of approximately equal size. It is also necessary to make sure that management practices are similar. This requires:

- Using soils of a similar type (unless different soil types are being tested).
- Using the same seed and same plant spacing (unless you are comparing varieties and/or spacing).
- Planting both areas of land on the same day (unless you are comparing planting dates).
- Applying the same amount of fertilizer (unless you are comparing different fertilizer or manure application rates).
- Weeding on the same day in the same way (unless you are comparing different types or times of weeding).
- Harvesting at the same time.

The researcher/extension agent should act as a facilitator and encourage the selected institutions and farmers to experiment with the new ideas, guiding farmers to conduct simple comparisons between local practices and new techniques.

In the case of *Striga* or *Imperata*, a simple paired plot design where the new technique is placed side-by-side with normal farmer practice in the same field has been a an easy way for farmers themselves to compare the performance of the two (Box 8).

Box 8. A typical paired plot layout (showing typical dimensions).



Researchers can use the same plots to measure yields and growth parameters and at the same time use a series of paired plots from different farms for a more detailed statistical analysis.

Learning through experimentation. Farmers will often share their experiences informally amongst each other. This process of learning can be encouraged by good facilitation. Learning in this way is critical to the success of participatory research and extension and lends itself towards using the test and demonstration plots for training (Box 9).

Observing the trials helps to identify the reasons why one technique performs better or worse than another. When crops are grown with two different techniques, side-by-side, the differences are usually easily visible. The crops may be larger and bigger and the weeds may be few or take less time to weed. Such observations should be recorded so that they are not forgotten and can be analysed in more detail in the future. A record sheet allows experiences to be shared with others. This is part of the monitoring and evaluation process.

Box 9. Using test plots for training and demonstration.

The training area for the other farmers in the group can center on the lead farmer's test plot with other farmers encouraged to test the technique on a plot of their own. In this situation, the field becomes a teacher, providing most of the training materials, such as plants, pests and real problems. Farmers are usually much more comfortable in a field situation than in a classroom. The lead farmer should ensure that other farmers know the date and time and attend training sessions at key stages during the crop cycle. This includes:

- Identifying and marking out the plot.
- Preparing the land for sowing.
- Sowing the crop.
- Applying fertilizer.
- Weeding.
- Comparing the effect of the new treatment with the farmer's normal practice.
- Harvesting.
- Evaluating the impact of the new treatment in increasing yields or reducing inputs.

Immediately after each training session, other farmers can undertake the same work on their own plots.

Stage 4. Sharing experiences

Monitoring and evaluation. Monitoring and evaluation (M&E) should be an integral part of any testing process and the earlier it is incorporated into program activities, the better. M&E allows farmers, researchers, and extension agents to ensure that Steps 1–3 in the PREA are addressing community problems and concerns and their livelihoods are actually improving. This requires the use of indicators as signs of change. These need to be relevant, easily observable, verifiable, and accurate.

- Monitoring refers to the collection and analysis of information to compare progress of an activity with an original plan.
- Evaluation is the periodic assessment and review of the extent to which medium and long-term objectives have been reached.

M&E helps to assess performance, to share results and experiences with others, to learn from achievements and mistakes and develop capacity to perform better in the future and to fulfil reporting obligations. M&E should help in constantly reviewing the trials, reflecting, learning and replanning. Information requirements should be kept to a minimum. Choosing a few practical indicators, which quickly and effectively provide accurate information, can achieve this. M&E indicators should be easily and quickly recorded with maximum community involvement in both collection and analysis (Box 10).

Box 10. Participatory monitoring and evaluation.

- Start M&E as early as possible, and not later than, when the activity has been selected.
- Agree on why M&E needs to happen.
- Agree on what is to be monitored and evaluated.
- Identify practical indicators for this, which can be measured.
- For each indicator, agree on a scoring mechanism and agree who will collect the information and when.
- Agree on how the information is to be recorded.
- Practice the methodology.
- Have regular monitoring sessions, when information can be collected and discussed.
- Facilitate regular evaluation sessions.

Often M&E for research or extension and M&E for community needs are different, although parts will be common. M&E from a community perspective needs to enable the community to become involved in joint learning by sharing ideas and experiences and reflecting on the success and failures of the research undertaken. Informal sharing of experiences among neighbors and friends is unlikely to be sufficient to make the information available to everyone in the community. Within most natural resource projects, this requires two more formal steps:

- A midseason monitoring and evaluation of the new practices being tested.
- An end-of-season evaluation where the whole process can be evaluated and plans made for the coming season.

Midseason monitoring and evaluation. In the middle of the season before crops mature, farmers with the help of researchers and extension staff should organize to monitor the field performance of the technologies that have been tried. All farmers in the community should be invited to visit the experiments with each host farmer presenting their trial and their views to date. This helps to share the knowledge, and build confidence through presentation, as well as encourage farmer-to-farmer extension.

After everyone has had a chance to look at the different technologies, it is important to analyze the findings. This helps men, women, and young people to do this separately so that any differences in perspective become apparent. This assessment can be done using participatory tools.

- Listing the advantage and disadvantages of each treatment.
- Establishing the most important criteria (for example, cost, labor requirement, effect on overall risk, effectiveness, material availability, and yield).

- Scoring each of the technologies using a matrix of technologies and criteria by putting up to three stones (or crosses) in each criterion box. The higher the score, the better the technology.

An example of each these tools used for midseason monitoring and evaluation is shown in Annex 11.

End-of-season evaluation. Once the experimentation crop is harvested and the trial completed, conclusions can be made regarding the technology under investigation and decisions made with regard to additional trials to be undertaken the next season. This requires:

- Confirming the advantages (benefits) and disadvantages (costs and risks) of each practice.
- Agreeing which of these can be valued.
- Agreeing these values.
- Comparing each new treatment with the farmer practice by assessing any increases in the value of the crop or crop residue, less any increase (or decrease) in costs. Costs should include both purchased and household supplied items.

A participatory partial budget approach can be used for this purpose.

An example for an end-of-season evaluation of trials is shown in Annex 12.

Process review. Ideally one or two months before the start of the new season, a review and planning workshop needs to be organized with the community. This should review the whole process, assessing it against the planned activities and the indicators for success, which farmers suggested during the planning phase. This includes criteria such as leadership, strengthening of self-organizational capacities as well as the participation of everyone including the poor in the process. This analysis normally leads to the next cycle, which starts, again with issues of social mobilization and situational analysis, the community reviewing their goals and objectives and developing an action plan for the next season.

5 Building capacity for participatory research and development approaches

Extension agents. PREA is a process learning cycle, which requires flexibility in its implementation. The complexities of rural situations require that capacity is developed and institutional approach is changed to create an environment, conducive for the process to be accepted. It may mean a change for extension agents away from being technical advisors to process leaders and facilitators.

Participatory development processes are not blueprints and cannot be predicted in terms of output. Each community is different. Some may be well organized with many different community organizations with strong participatory leadership, and as a result, well motivated to solve problems. Others may lack any local institutions or leadership and have many internal conflicts. The need is to develop capacity and bring about institutional culture change. The challenge is how to make the transition from being technically driven to one which attaches importance to partnership, collaboration, and sharing in the development process. This requires a reorientation of extension staff that goes beyond training on the use of participatory tools or new technical solutions. The shift from teacher to facilitator involves new skills, different attitudes and behavior. These new skills require that extension workers develop them in practical situations (Box 11). They cannot be learnt in the classroom.

Box 11. Typical PREA training process for extension agents.

Planning phase: One-week training workshop on PREA in a training center

- Exposure to main concepts of PREA
- Introduction to and use of key tools for initial steps in PREA
- Creating an operational framework
- Technical training in *Striga* or *Imperata* biology and control options
- Individual action plans for extension agents to try out PREA in their own areas
- Report writing and deadlines

Field implementation phase 1: (lasting about six months)

- Implementing action plan with backstopping by trainers in the field
- Identifying priority crops, community institutions, priority problems, and existing coping mechanisms
- Searching for new ideas through exchange visits to other farmers and research stations
- Agreeing on an action plan, selecting community institutions, and lead farmers to try out new ideas
- Implementing farmer-managed trials

Planning for sharing experiences: three-day training workshop

- Sharing of field experiences and joint learning
- Facilitating farmer-led field days
- Midseason monitoring and evaluation processes, pairwise and matrix ranking
- End of season evaluations and participatory budgeting
- Individual action plans for each extension agent for phase 2
- Field implementation phase 2: (lasting about six months)
- Implementing phase 2 action plan with backstopping by trainers in the field
- Mid and end-of-season evaluations

Process review: three-day workshop

- Sharing field experiences, positive and negative aspects
- Reviewing the whole process and planning for future activities

During the first training workshop, a program for the year was agreed, against which extension agents were required to report.

An example of schedule for a program of activities is shown in Annex 1.

Lead farmers. Lead farmers can play a key role in the process of farmer-to-farmer diffusion. Not only have they been nominated by their groups to test new technologies, they have the potential to:

- Strengthen the group leadership, improve organizational and planning capacities
- Assist in teaching group members basic technical skills
- Facilitate communication between the group and the extension agent.

To undertake these tasks, training in leadership and communication will play an important role (Box 12). These should be practical sessions building on already existing skills and include technical training on the problem that the communities are addressing. This is intended to promote farmer-to-farmer extension and diffusion of new technologies (Fig. 2).

Box 12. Typical training for lead farmers.

Role of lead farmers

- Ask the group to brainstorm on the different responsibilities of a lead farmer. Compare these responsibilities to those of committees, chairperson, secretary, and treasurer of the group that nominated him/her. Note the farmer perceptions of his/her role.
- Work with the group to draw a diagram that represents the linkages between the lead farmer, his/her group, other members, the extension agent and other partners. Keep a record of this information.

Questions for discussion

- What should be the role of the lead farmers?
- What are the linkages with the groups that have nominated them?
- What are the linkages with other partners?
- What are the linkages with the extension agent?

Communication (information sharing and training)

- Ask the group to brainstorm on the different methods of sharing information and the role the lead farmer can play. Record (1) the preferred method of receiving information (in priority order) and (2) the most commonly used methods.
- Work with the group to draw a diagram that represents the linkages between the lead farmer, his trial plot, the secondary farmers and their trial plots, other farmers in his/her group and the extension agent. Record this information.

Questions for discussion

- What should be the role of the lead farmers in sharing knowledge?
- What are the linkages with the secondary farmers?
- What is the best method of sharing knowledge with them?
- How best can the extension agent support these activities?

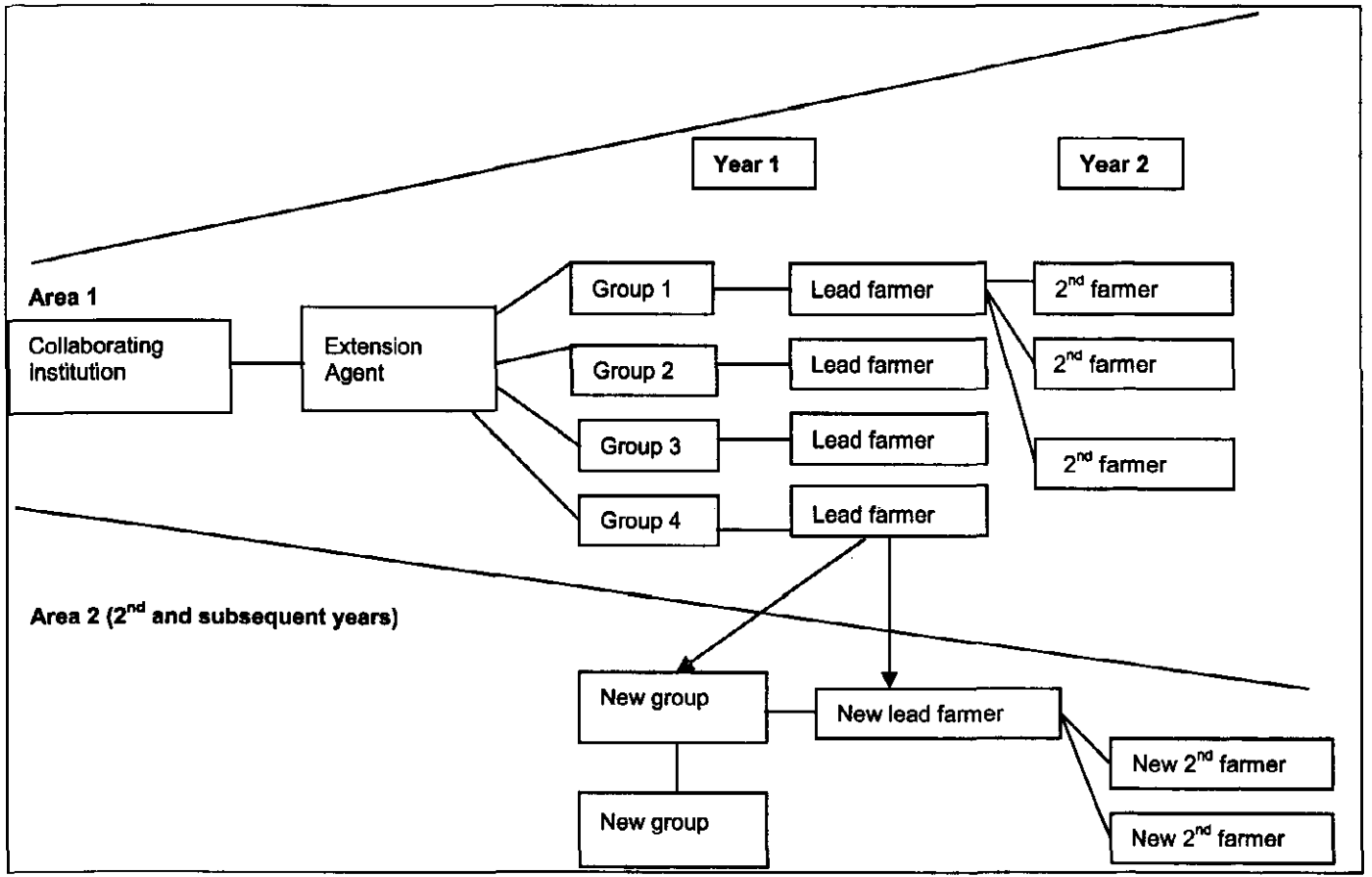


Figure 2. *Promoting farmer-to-farmer extension.*

Annex 1. An example of an extension agent's program for the PREA process

It is essential that a program is drawn up and agreed upon, identifying key activities and when they should be undertaken and who will be responsible for their facilitation and ensuring activities are completed (Table 3).

Table 3. Typical timetable used for a PREA for *Imperata* control.

Activity	J	F	M	A	M	J	J	A	S	O	N	D	J	Responsibility
Stage 1. Social mobilization														
Identify local institutions		x	x											EA
Identify crop priorities		x	x											EA
Identify problem priorities		x	x											EA
Identify existing methods of *Imperata* control		x	x											EA
Raise awareness of *Imperata*		x	x											EA
Stage 2. Action planning	J	F	M	A	M	J	J	A	S	O	N	D	J	Responsibility
Discuss alternative methods for controlling *Imperata*			x	x										Group/LF/EA
Mandate local institutions/select LFs			x	x										Group/LF/EA
Agree *Imperata* control methods/crops to be used			x	x										Group/LF/EA
Farmers to confirm plots to be used				x	x									Group/LF/EA
Identify input requirements			x	x	x									Group/LF/EA
Arrange competitions between farmers groups				x	x									Group/LF/EA
Stage 3. Implementation	J	F	M	A	M	J	J	A	S	O	N	D	J	Responsibility
Obtain inputs				x	x	x								EA/LF
Mark plots				x	x	x								EA/LF
Plant trials				x	x	x								EA/LF
Harvest trials (maize, soybeans)									x	x				EA/LF
Use existing LF plots for training (FFS)					x	x	x	x	x					EA/LF
Encourage LFs to visit/assist others					x	x	x	x	x					LF
Stage 4. Sharing experiences	J	F	M	A	M	J	J	A	S	O	N	D	J	Responsibility
Midseason evaluations by each community (field days)										x	x			Group/EA/LF
Joint evaluations														
End-of-season participatory evaluations														
Visit plot, ensure LF explains detail to farmer group											x	x	x	Group/LF/EA
Facilitate discussions on advantages/ disadvantages											x	x	x	EA
Facilitate partial budgets											x	x	x	EA
Deadlines for reports	J	F	M	A	M	J	J	A	S	O	N	D	J	Responsibility
Monthly reports	x	x	x	x	x	x	x	x	x	x	x	x	x	EA
Completion of social mobilization forms			x											EA
Trial plans and input requirements			x											EA
Field data sheets										x	x	x		EA
Midseason monitoring and evaluation									x					EA
End-of-season evaluation												x	x	EA

LF = lead farmer, EA = extension agent, Group = farmers' group, ES = extension supervisor, FFS = farmer field school

Annex 2. Typical livelihood analysis

The aim of this activity is to assist participants to assess the means by which different members of the community derive their livelihood, the importance of each in providing food and cash income, trends and the reasons for such changes. In this case, the information helped to identify those livelihoods which were affected by two noxious weeds i.e. speargrass (*Imperata cylindrica*) and witchweed (*Striga hermonthica*).

Steps for undertaking this activity

This can be undertaken in mixed or gender-specific groups.

1. Make sure everyone knows the purpose of the exercise.
2. Identify all the means of deriving a livelihood within each community.
3. Crop production can be regarded as one generic subject or if necessary if more detail is going to be obtained later as individual crops.
4. Identify who in the community, (men, women, boys or girls) is involved, and the percentage of households participating.
5. Establish the relative importance of each activity for growing food or earning money. This can be done on a scale of 1–4 (1 = not important, 4 = very important).
6. Establish the trend, whether this activity is increasing or decreasing and why.
7. Record the information on a matrix as the information is discussed and agreed.

An example. At the end of the process, information was available to researchers and the community on the following:

- How people derived their livelihoods.
- The extent of peoples' involvement in each of the livelihood strategies.
- The relative importance of each.
- Trends in the performance of these livelihood means over the years.
- The reasons for such trends.

Findings from the livelihood analysis (Table 4) reveal that a total of 18 activities were identified as livelihood sources within the community, the main ones being livestock keeping, crop production, trading, and casual labor for farm work.

Livestock. All households (both men and women) were involved in livestock keeping mostly for consumption but also some for cash sales. Keeping of livestock was increasing as it provided a regular income.

Crops. Most households (80%) were involved, again both men and women, with produce being for both home consumption and sale. Cropping activity was seen to be decreasing as a result of weed infestation problems, especially *Striga* and a lack of availability of inputs.

Trading. Most households (70%), with men, women, and youth participating are involved in trading activities. This comprises buying and reselling of household requirements including food, primarily to purchase food but also for purchasing other household needs. These activities are decreasing as a result of lack of funds and goods for trading.

Casual labor. Most of the youth (60%) are involved in undertaking casual work mostly farm work, which is increasing as there are few other employment activities.

There is a large range of other activities from which households derive a livelihood, partly as a result of the area's proximity to an urban area.

Table 4. *A typical livelihood analysis.*

Activity	% Involved in community	Who	Relative importance For food	Relative importance For cash	Trend increasing or decreasing and why?
Livestock	100	Men and women	4	2	Increasing, provides income
Crop production	80	Men and women	2	4	Decreasing due to weeds, lack of inputs
Trading	70	All	3	2	Decreasing, due to lack of capital
Casual labor for farm work	60	Youth	4	3	Increasing, lack of other work
Driving (taxis, lorries etc.)	50	Men	3	2	Decreasing, due to lack of motors
Mason/bricklayers	50	Men	2	2	Increasing, due to increased use of cement
Tailoring	40	All	3	2	Decreasing, due to poverty (people do not have money)
Carpentry	30	Men	3	2	Decreasing, due to lack of encouragement
Motor bikes (taxi)	30	Men	2	1	Increasing, due to lack of other work
Machine mechanics	30	Men	2	2	Decreasing, due to lack of demand
Religious leaders	30	Men	0	3	Increasing, due to increase in knowledge
Welding	30	Men	2	1	Increasing, due to increased use of metal materials
Teaching	30	Men and women	2	2	Increasing, due to increased knowledge
Animal slaughtering	20	Men	3	1	Decreasing, due to financial limitations
Milling	20	All	3	2	Increasing, due to high demand
Electricians	20	Men	3	2	Increasing, due to increased use of electricity
Rulership/leadership	10	Men	0	2	Decreasing, as area was reduced. Others argued it was increasing
Radio repair	10	Men	2	2	Increasing, due to increased number of radios

1 = least important, 4 = most important. Source: Dambo community, Zaria Local Government, Kaduna State, 2002.

Annex 3. Resource (or wealth) ranking

The aim is to assist the participants to identify different types of households in the community using their criteria for assessing differences. This is likely to have relevance in establishing how *Imperata* and *Striga* affect each group, how they presently cope with it, and what future management strategy may be effective.

An example. In this example (Table 5), participants indicated their criteria for wealth to include: food availability, type of house, family size, types and numbers of livestock, farm size, access to inputs (especially fertilizer) and access to cash (especially through off-farm activities).

Table 5. Typical results from a wealth ranking exercise.

Indicator	Category		
	Well resourced	Average resources	Poorly resourced
Food	Enough food (yam) throughout the season.	Yam supplemented with sorghum during off-season.	Minimal stock of food. Depends mainly on sorghum during off-season
House	Zinc-roofed building with adequate furnishing (chairs, electronics, etc.).	Zinc-roofed house (cement or mud) with minimal furniture	Thatch-roofed mud house
Family size	A family of 24 (1 man, 3 wives and 20 children), adequate care	1 man, 1 or more wives, 10–20 children, adequate care	1 man, 1 wife, less than 10 children. Female headed household, inadequate care
Livestock	Cattle - >20 sheep/goat-20–40 pigs->17 poultry – 80–100 birds	Cattle - <20 Sheep/goat – 20–40 Pig - >17 Poultry - <20 birds	Cattle–0 Sheep/goat–0 Pig–0 Poultry- < 5
Farm size (ha)	More than 2	About 2	Less than 1
Access to inputs especially fertilizer	More than 10 bags. Sells to other farmers	5–10 bags	None
Main source of cash	Farming and trading or other off-farm employment	Farming. Only a little trading	Farming only
Estimate of % in community	20%	30%	50%

Source: Tarka Local Government, Benue State, 2002.

Steps for undertaking a resource or wealth ranking exercise

This activity can be undertaken in mixed or gender separated groups

1. Make sure everyone knows the purpose of the exercise.
2. Identify with participants the criteria they use in differentiating households.
3. Agree on how many categories there are in the community. Usually this varies between three and five.
4. Describe for each category a typical profile for each criterion.
5. Ask participants to estimate what percentage of the community fall into each category.

Annex 4. Institutional analysis

The aim is to assist participants to identify institutions within the community that are already or would like to be involved in *Imperata* and *Striga* management.

An example. This group identified 10 community-based organizations (CBOs) and two external organizations working in the community, ADP and DDS (Table 6). Two CBOs were selected to work at resolving their *Imperata* problem, these being the Emere Youth Association and Emere Farmers' Association.

Table 6. *Typical institutions within the community.*

Institutions	Abbreviation	Number of participants	Most important
Emere Youth Association*	EYA	100	2
Nigerian Association of Transport Association	NATO	7	
National Union of Road Transport Workers	NURTW	18	
Emere Community Development Association	ECDA	411	1
Dynamic Club of Emere	DCE	32	3=
Women Palm oil Processing Association	WPPA	35	3=
Hunting Association	HA	100	
Moral Club of Emere	MCE	72	
Dynamic Young Club of Emere	DYCE	53	
Aloja Farm (Emere Farmers' Association)*	AF	32	3=
Agricultural Development Project	ADP	1	
Diocesan Development Services	DDS	1	

*Organizations identified as being able to deal with *Imperata*.
Source: Emere Community, Ankpa Local Government, Kogi State, 2002.

The relationships between the different institutions are shown in Figure 3.

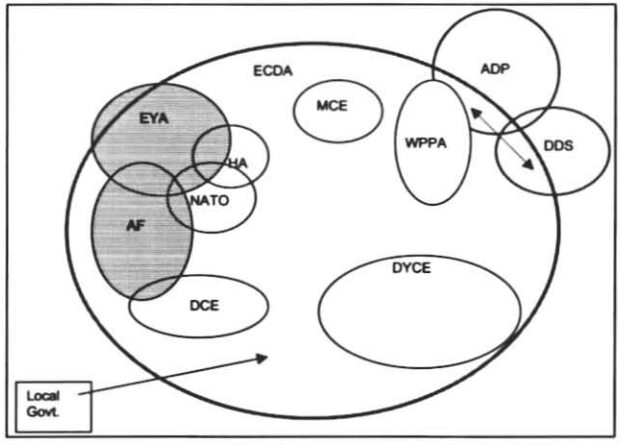


Figure 3. *Typical venn diagram (for Emere community 2002).*

Steps for undertaking an institutional analysis

Small groups organized according to gender, age, or wealth can create visual diagrams, which reflect their perceptions of the relationship between institutions and the people they serve.

1. Make sure everyone knows the purpose of the exercise.
2. Identify and list the institutions within and outside the community at local (village), local government and state levels. Identify which institutions interact with each other.
3. Draw circles to represent these institutions. Their perceived importance is rated by the size, the larger the more important. The further the circle is away from the center of the diagram, the less contact it has with the community.
4. Agree on which local institution would be best to become involved in the action program. Opinions can vary considerably but when discussed, it helps in creating a common understanding of which institution is best placed to undertake the required tasks.
5. Such diagrams are easier to construct if the relevant topic is selected, such as management of natural resources rather than having a general discussion on all community structures in the abstract.

Annex 5. Crop priority preference ranking

The aim is to assist participants in arranging their crops in order of importance based on community criteria so as to show which of the most important crops are affected by *Imperata* and *Striga*. Preference ranking is a quick method to identify the preferences of groups of people. It is similar to voting and involves asking each respondent in turn to rank his/her preferences. By adding all the scores, we have an idea of the groups' overall preference, in these case crops.

An example. In the example shown here, only the views of men were obtained as there were no crops particularly cultivated by women in this muslim community. Groundnuts, maize, sorghum, and cowpeas were the preferred crops (Table 7). Reasons for ranking groundnuts as most important were that it was both a food and cash crop and did not require fertilizer. Maize and sorghum were equally important, again both being food and cash crops with potential for high yields, but *Striga* is a major problem. Cowpeas also provided good fodder for livestock.

The crops attacked by *Striga* are maize, sorghum, and rice.

Steps for undertaking a preference ranking

This can be undertaken in gender and age divided groups to obtain gender and age perspective

1. Identify all the crops grown in the community.
2. Ask each person to indicate which is most important for him or her and to state the reasons for this.
3. Undertake ranking by showing hands or placing stones against a symbol representing each crop.

Ranking can also be undertaken using pairwise ranking (Annex 7). It can also be undertaken for food and cash crops independently.

Table 7. *Typical crop priority preference ranking.*

Crop	Score	Rank	Reason
Groundnut	29	1	It is a food and cash crop that does not require fertilizer and is very well adapted to this area.
Maize	28	2	Food and cash crop. It is high yielding and easy to weed, but *Striga* is a problem.
Sorghum	27	3	Food and cash crop. High yielding and easy to weed and does not require much fertilizer. Striga is a problem.
Cowpea	21	4	Food and cash crop. It also provides good fodder for livestock.
Yam	19	5	Food and cash crop. Improves soil.
Pepper	17	6	Cash crop.
Tomatoes	13	7	Cash crop.
Soybean	7	8	New crop in the area.
Rice	6	9	Only suited to some areas.

Source: Karau-Karau, Zaria Local Government, Kaduna State, 2002.

Annex 6. Seasonal crop calendar

The aim is to assist participants to identify the main activities undertaken for each crop during the year. This helps to identify the busiest times of year and assists in highlighting problem periods.

Steps for preparing a cropping calendar

This can be undertaken in gender divided groups to obtain gender perspectives

1. Confirm the main crops grown in the community.
2. Establish the main activities undertaken from land preparation up until harvest, consumption, or sale.
3. Agree on which activities take place in which months.
4. Establish when the problems (for instance, controlling *Striga* or *Imperata*) are at their greatest.

An example. A typical crop calendar (Table 8) is shown for the main crops grown in the area, with *Imperata* being a problem during all months of the years.

Table 8. Typical crop calendar.

Crop	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Yam	W	W		H	H	H		LP	LP	P	P	W
Cassava				LP	LP	P	P	W	W	H	H	H
Sorghum			LP	LP	P	P	W	W		H	H	
Maize			LP	LP	P	P	W	W		H	H	
Soybean	TH	TH			LP	LP	P	P	W	W	H	H
Rice			LP	LP	P	P	W	W	W	W	H	H
Imperata problem			X	X	X	X	X	X	X	X	X	X

LP = land preparation, P = planting, W = weeding, H = harvest, St = storage, TH = threshing.
Source: Tarka Local Government Area, Benue State.

A calendar such as this could be expanded, if necessary, to show livestock and even non-farm activities. Most calendars are shown on a monthly basis, but others can be constructed on a weekly or even a daily basis to show the range of activities carried out over a typical week or day.

Annex 7. Problem priority pairwise ranking

The aim is to assist participants to identify and rank the problems that they are facing in producing their crops. Pairwise ranking is a useful technique to find out the reasons for a particular choice, but it can only be used when there are not too many problems (a maximum of 6–7).

Steps for undertaking a pairwise ranking

This can be done in mixed, gender or youth-specific groups.

1. Make sure everyone knows the purpose of the exercise.
2. List all the problems. It may be necessary to limit these to natural resource problems.
3. Ask participants to decide which are the most important, limiting these to not more than 6 or 7 through mutual agreement, hand or stone voting.
4. Prepare a blank matrix such as that shown in Table 9.
5. Compare each problem against all the others, in pairs going through each pair in turn. This gives participants two options to discuss and agree on which is more serious.
6. Make comparisons of all the possible pairs (starting with weeds and fertilizer availability), recording the greater problem for each comparison.
7. Add the number of times each problem is scored and then rank.

Note: Only one-half of the table is used.

An example. Of the seven priority problems, weeds, first *Striga*, followed by *Rotboellia* and then *Imperata*, were rated as the most serious problem (Table 9). *Striga* in particular could lead to total crop failure in cereal crops. *Imperata* can be beneficial to farmers as roofing materials or even sold for income. One other important weed affecting crop yields is *Rotboellia cochinchinensis* (itchgrass). Participants pleaded that attention should be given to all, *Striga*, *Imperata*, and *Rottboellia*.

The participants confirmed that *Imperata* could be controlled by handweeding while *Striga* could not.

Table 9. Typical ranking undertaken by a mixed group of men and women.

Problems	Weeds	Fertilizer	Pests	Disease	Cash	Access	Prices	Total	Rank
Weeds[1] (W)	x	W	W	W	W	W	W	6	1
Fertilizer availability (FA)	x	x	FA	FA	LC	FA	FA	4	3
Crop pests (CP)	x	x	x	CP	LC	CP	CP	3	4
Livestock diseases (LD)	x	x	x	x	LC	AM	MP	0	7
Lack of cash (LC)	x	x	x	x	x	LC	LC	5	2
Poor access to market (AM)	x	x	x	x	x	x	MP	1	6
Poor market prices (MP)	x	x	x	x	x	x	x	2	5

[1]Weeds include *Striga*, *Imperata*, and *Rottboellia*.

Source: Tarka Local Government, Benue State.

Annex 8. Scored causal diagram of a priority problem

This aims to assist participants to understand the causes of problems by increasing awareness and to help in identifying possible options for control.

Steps for undertaking a causal diagram

1. Make sure everyone knows the purpose of the exercise.
2. Place the problem at the top of a sheet of paper (or board).
3. Ask participants to list and discuss all the causes of a problem, asking "Why did this happen?", or "Why did this occur?"
4. Through discussion, further problems and causes may be added to the diagram.
5. Scoring can be considered after the diagram has been completed using percentages (or numbers up to 10) to indicate contributory causes of the problem to one or more levels.

An example. The resulting causal diagram (Fig. 4) seen from the participants' perspective shows three main causes of *Striga* infestation: land contamination; soil impoverishment; and poor land preparation.

- Land contamination was caused first by, unclean seed (usually non-winnowed) purchased from the market and secondly, by contamination of land by cattle hooves and dung on cattle from Chad and Niger.
- Soil impoverishment was caused first by, continuous cropping due to insufficient land and secondly, by lack of fertilizer due to lack of capital/funds available to farmers.
- Poor land preparation was caused by lack of time and labor and laziness.

Through undertaking this analysis with farmers, researchers were able to gain a clear insight of what farmers attributed to *Striga* infestation, in particular:

- Farmers were aware of *Striga* contamination through seed purchased from market, the importance of winnowing as well as spread by cattle hooves and manure.
- Though farmers see impoverished soil as exacerbating *Striga* infestation, they were clear that *Striga* damage appears worse on nutrient-stressed crops.
- Farmers see poor or shallow land preparation as increasing the *Striga* problem. *Striga* seeds being concentrated in the topsoil and germinating faster under conditions of poor tillage may cause this.

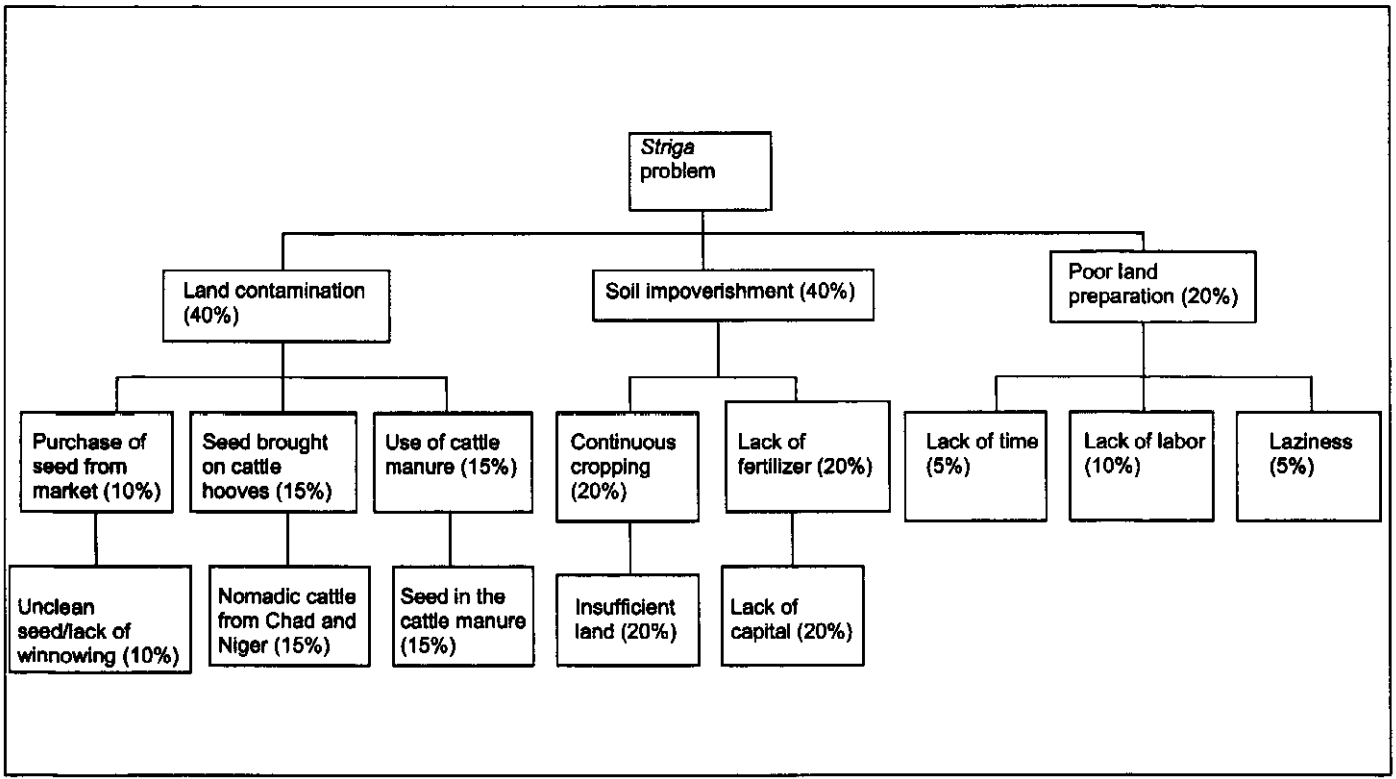


Figure 4. *Striga causal diagram (Karau Karau community, Kaduna State).*

Annex 9. Mapping (past, present, and future)

In cases where weeds are the most serious problem, participants can be assisted to map the distribution and intensity of the weeds in their community. After first establishing the present distribution, the map can be redrawn as the situation was, say, 10–15 years ago by those who can remember the situation at that time. Likewise another map of, say, 10–15 years into the future can be drawn to help visualize what might occur if the problem is not addressed. Drawing these past, present, and future maps of weed distribution can be a powerful tool for motivating a community to take action.

Steps for drawing maps

Involve as many in the group as possible in drawing, collecting symbols, and in discussion. Having a separate group of women will enhance their participation and men's and women's analysis can be compared.

1. Ensure everyone knows the purpose.
2. Use a sandy area in the shade to sketch out the boundaries of the community area. Using the sand for drawing allows mistakes to be corrected easily.
3. Agree on what features should be identified (typically roads, streams, hills, boreholes, school, church, mosque, houses, arable areas, grazing areas). Keep these to a minimum so that people can identify their whereabouts and there is room to show the weed problem.
4. Select a symbol for each feature and mark each feature on the sand.
5. Copy the map onto a piece of large paper for discussion with others and use at a later meeting.
6. Ask participants to discuss the implications of the spread of the weed.

Let the community keep the maps for their own discussions.

Example. Three maps (Figs 5, 6, and 7) are shown for Dambo, in Kaduna State, a community, which ranks increasing *Striga* as one of its most serious problems. The results show that although *Striga* was present 15 years ago, its incidence has now spread considerably and unless action is taken for its control, it is likely that infestation in another 15 years will prevent cereal cropping.

15 years ago, there were few houses and a low population. Land was abundant for both crop farming and rearing of livestock. The soil was very fertile and land could be fallowed for 3–4 years. The government provided fertilizer for crop farming and crop yields were high (9–10 bags per field). *Striga* infestation was low compared to the present. Farming was restricted to land areas around the small river that surrounds the community. The main *Striga* control measure was handpulling. Rich farmers employed the youth to hand-pull *Striga* plants on their fields.

At present (2002), the population has increased and there are more houses. A school, clinic, and mosque have been built on previously *Striga* infested farmland. Soil fertility has declined and yields are low (3–4 bags per field) due to increasing *Striga* attack, limited cash to purchase fertilizer, short fallow period, and the absence of manure from cow dung due to movement of livestock owners out of the area. *Striga* infestation has been increasing over the years. Farmers resort to planting cowpea instead of sorghum and maize. Rich farmers take control of the fertilizer allocated to the village, leaving a small quantity for the poor farmers.

In the future (15 years time), the population will increase. There will be land shortage, even lower soil fertility if fertilizer is not provided. *Striga* infestation will increase and yields will decline to almost nothing.

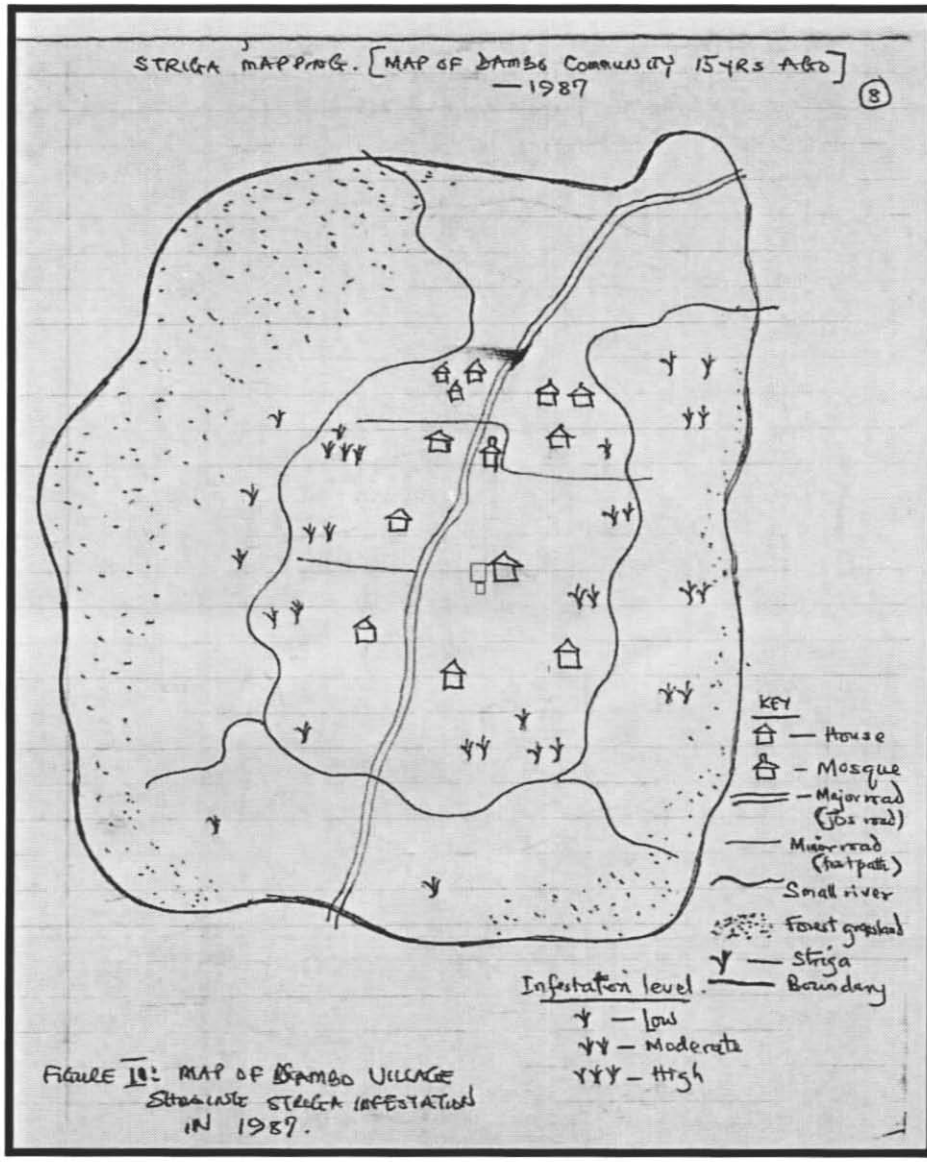


Figure 5. *Dambo, 15 years ago.*

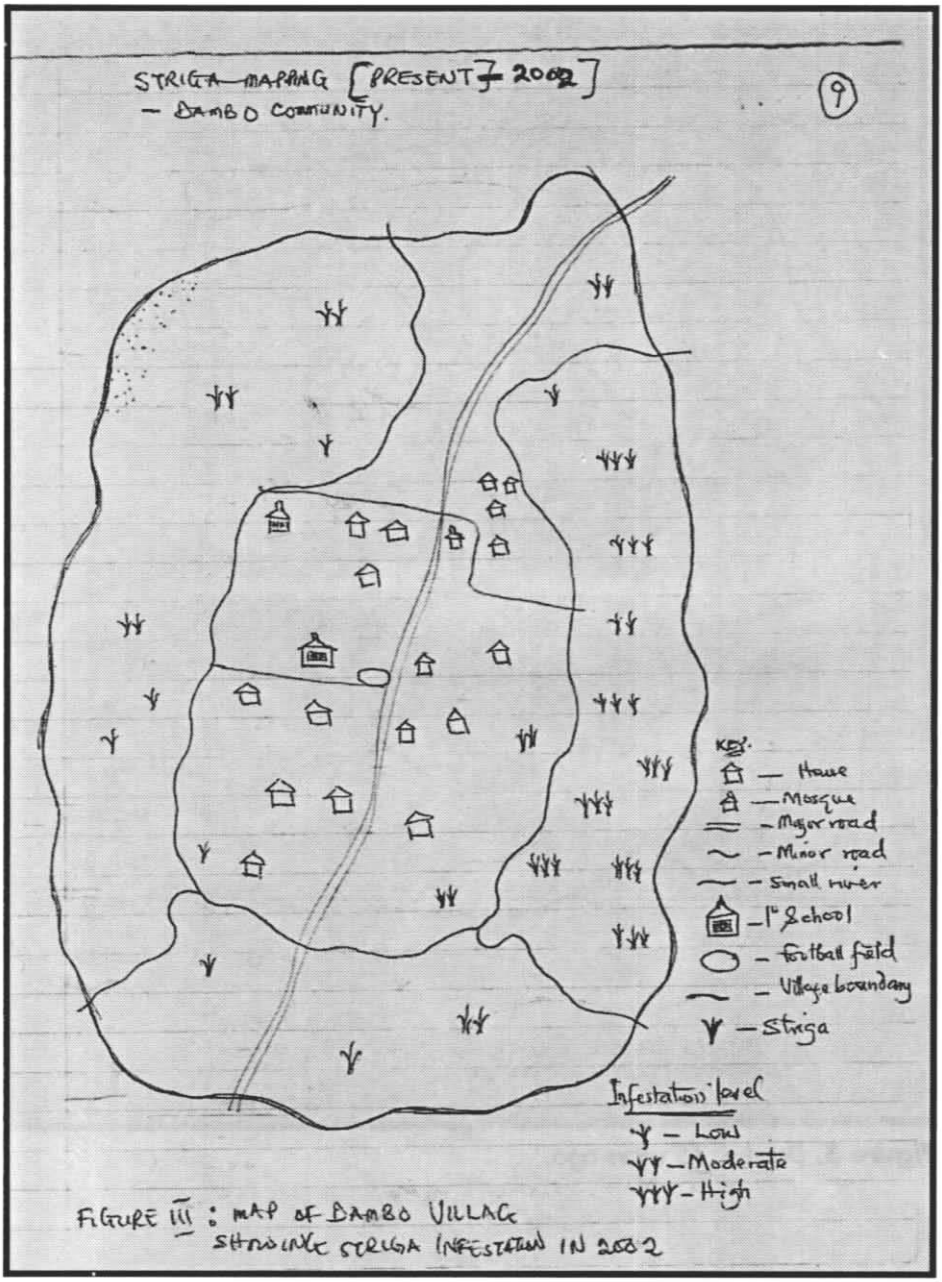


Figure 6. *Dambo, at present.*

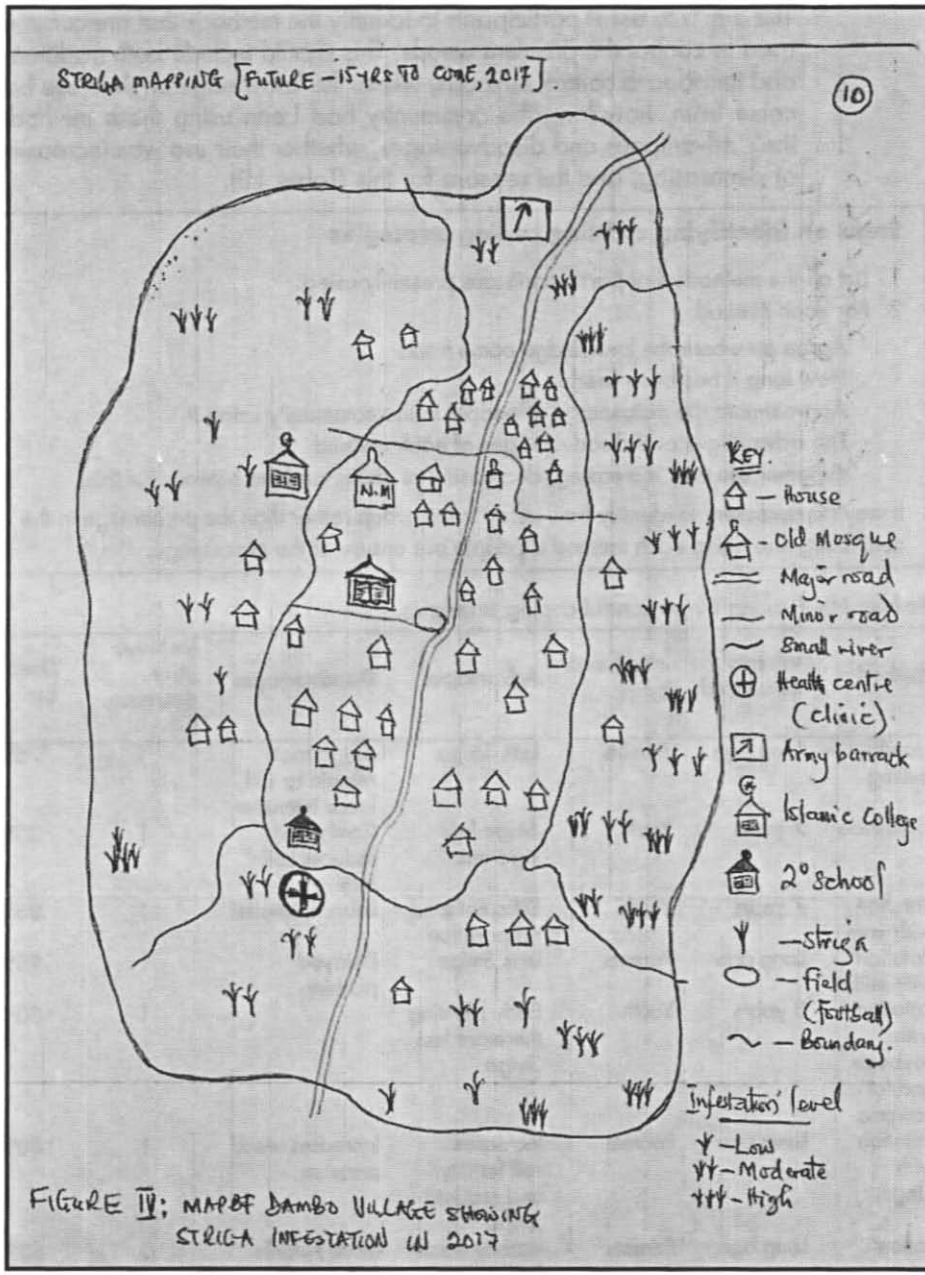


Figure 7. *Dambo, in 15 years time.*

Annex 10. Establishing existing coping strategies

The aim is to assist participants to identify the methods that are currently used to control the problem weeds. This should include both traditional and introduced control methods, where the knowledge on their use had come from, how long the community had been using these methods, their advantages and disadvantages, whether their use was increasing or decreasing, and the reasons for this (Table 10).

Steps on identifying existing coping strategies

1. List all the methods that participants are presently using.
2. For each method:
   - Agree on where the knowledge came from.
   - How long it has been used.
   - Approximate the percentage of people in the community using it.
   - The advantages and disadvantages of each method.
   - Whether use was increasing, decreasing or static, and the reasons for this.

It may be necessary to identify how many in the group rather than the percentage in the community are using each method if people are unsure of the percentage.

Table 10. Existing *Striga* control coping strategies.

Method	When introduced	Introduced by	Advantages	Disadvantages	Increase (I) or decrease (D)	Used by
Hand pulling	Long ago	Parents	Less *Striga*	*Striga* roots remain in soil, labor intensive	I	75%
Herbicide	7 years	Youth	*Striga* less vigorous	Costly and reduces soil fertility	I	25%
Rotation with yam	7 years	Youth	Different land preparation	Labor intensive	I	85%
Rotation with millet	Long ago	Parents	Less *Striga*	Delayed planting	I	95%
Rotation with soybean and/or cowpea	8 years	Youth	Early planting therefore less *Striga*		I	50%
Rotation with ginger	Long ago	Parents	Increases soil fertility and reduces *Striga*	Increases weed pressure	I	100%
Fallow	Long ago	Parents	Increases soil fertility	More Fulanis in the area, therefore more erosion	D	50%

Example. An example is shown for Abron community in Kaduna State, Nigeria.

Comments: Fallow periods on average are five years, but fallow length is decreasing.

Annex 11. Midseason monitoring and evaluation of trials

The aim is to allow participants to assess the different weed management treatments during a field day, when the differences between the treatments are visually most apparent. This should involve:

- Establishing the advantages and disadvantages of the technologies being tested.
- Undertaking a pair-wise and/or matrix ranking for farmers to select the best.

This assessment can be used not only for farmers' trials, but also for any mother trials that farmers may visit.

A typical program for a field day for midseason monitoring and evaluation of trials could comprise

0800 Opening, typically with a prayer at a central point.
Welcome to guests and participants.
Brief explanation of the background to the experiments

0830 Visits to each farmer's trials in groups, each group inspecting the trials with a rapporteur and recording the advantages and disadvantages of each treatment.

0930 Each group assesses the trials using pairwise and matrix ranking using criteria agreed on during the inspection.

1030 Each group presents their results for discussion with other participants.

1130 Refreshments and closure with a prayer.

Establishing advantages and disadvantages of alternative treatments. In this example, farmers identified the advantages and disadvantages of controlling *Imperata* in cassava with a herbicide (Glyphosate), used either on its own or in conjunction with a cover crop (*Mucuna*), comparing this to handweeding (Table 11).

A final evaluation can be made only when the crop is harvested.

Pairwise ranking of six treatments. In this example, pairwise ranking has been used to compare treatments in pairs as described in Annex 6. Of six *Imperata* treatments, pre-tillage Glyphosate has been judged the best with both post-tillage Glyphosate and post-tillage Fusilade treatments ranking second equal. Handweeding was ranked the worst treatment (Table 12).

Matrix ranking. From the advantages and disadvantages established when existing coping strategies are analysed (Table 13), it is possible to identify what criteria people use to assess alternative weed control methods. Matrix ranking helps to evaluate the performance of the technologies in relation to these criteria

Table 11. Advantages and disadvantages of Glyphosate and *Mucuna* use in *Imperata* control.

Advantages	Disadvantages
Glyphosate	
Fast weeding/reduces labor/time for rest	Chemical can affect humans
Adds fertilizer	Delays planting of other crops
Crop grows faster	Money is needed to buy chemicals
Snakes are driven away	Seasonal availability of Glyphosate
Harvest is easier	Cost of application (hiring contractors)
More tubers are expected	
Cassava stems are thicker	
Mucuna	
Canopy protects crop from heat	Suppresses crop
Mucuna disturbs *Imperata*	Small cassava stems
Ground is made soft	Weeding difficult
Soil fertility is improved for next year	No immediate soil fertility improvement
	Some snakes in the dry season

Source: Ekumtak community, Ogoja Local Government Area, Cross River State, 2003.

Table 12. Pairwise ranking of treatments.

Treatment	Pre-t Gl	Post-t Gl	Post-t Gl +Mc	Post-t F	Mc only	HW	Total	Rank
Pre-tillage Glyphosate	x	Pre-t Gl	Pre-t Gl	Pre-t Gl	Pre-t Gl	Pre-t Gl	5	1
Post-tillage Glyphosate	x	x	Post-t Gl	Post-t F	Post-t Gl	Post-t Gl	4	2=
Post-tillage Glyphosate and *Mucuna*	x	x	x	Post-t F	Post-t Gl +Mc	Post-t Gl +Mc	2	4
Post-tillage Fusilade	x	x	x	x	Post-t F	Post-t F	4	2=
Mucuna only	x	x	x	x	x	Mc	1	5
Hand weeding	x	x	x	x	x	x	0	6

Source: A Community mid season evaluation in Tarka Local Government Area, Benue State.

This is an example of matrix ranking of different methods of controlling *Imperata* in cassava, based on a list of criteria agreed with participants (Table 13).

In this example Fusilade applied after tillage was ranked highest, marginally higher than Glyphosate used either pre-tillage or post-tillage in combination with *Mucuna*. Handweeding was ranked higher than both Glyphosate applied post-tillage and *Mucuna* used on its own.

Steps in matrix ranking

1. Agree on what the different control methods are.
2. Discuss and agree on the criteria that should be applied in assessing the different control options.
3. Ask participants to score each control method against each of the criteria, recording the information on a matrix. Use stones, dots, or numbers (as in this example) for recording the scores.
4. Add scores for each treatment. The more stones or the higher the score, the better the technology.
5. Rank the treatments, while identifying key differences. For example herbicide treatments ranked much better than either handweeding or *Mucuna* only for labor requirement.

Table 13. Matrix ranking.

	Farmers ranking criteria							
Treatment	Labor requirement	Effective-ness	Cost	Availability of materials	Knowledge required	Yield	Score	Rank
Pre-tillage Glyphosate Post-tillage	3	3	1	2	1	3	13	2=
Glyphosate Post-tillage	3	2	1	2	1	2	11	4
Glyphosate and *Mucuna*	3	3	1	3	1	2	13	2=
Post-tillage Fusilade	3	3	1	3	1	3	14	1
Mucuna only	1	1	2	1	2	1	8	5
Handweed	1	3	1	3	3	1	12	3

3 = best, 2 = average, 1 = worst

Source: A community midseason evaluation in Tarka Local Government Area, Benue State.

Annex 12. End-of-season evaluation

Establishing the financial benefits. Once the trial crops have been harvested and the yields are known, conclusions can be reached about the technologies under observation for the past season. Results from the midseason monitoring, namely, the advantages and disadvantages and ranking identified during the midseason field days can be referred to and modified in light of any subsequent information.

However, the main aim is to assist participants to look at the costs and benefits of the new technologies. This is best achieved through developing a participatory budget that compares each of the technologies being tested.

An example of a treatment partial budget drawn up using participatory methods is shown in Table 14. It should be noted that the valuation of the crop harvested and the inputs supplied are based on farmers' valuations.

Steps for undertaking an end-of-season evaluation

1 Agree on a date, time, and place in advance.

2 Visit the plot with as a many of the group as possible to remind them what has been tested. Let the lead farmer explain what he/she has done. Have available the results of the midseason evaluation as well as any records that the farmer may have kept.

3 Confirm the findings of the midseason evaluations of the alternative weed control methods, but do not repeat the exercise.

4 Advantages (benefits) and disadvantages (costs).

5 Ranking of treatments.

6 Agree on which advantages or disadvantages items can be quantified in monetary terms and how it can be done (usually yields, seed, fertilizer, and labor costs, even if some of these are supplied by the household and not purchased).

7 Use local units of measurement that everyone can understand. This includes the land area (usually the actual plot itself), the crop harvested (grain and crop residue), seed, fertilizer, labor and if necessary draft animal or tractor costs.

8 Agree on local prices of inputs and outputs.

9 Facilitate the production of a partial budget. This means that when treatments incur the same management practice and cost, these do not need to be included. We are interested in measuring differences between each new treatment and the farmers' normal practice.

10 After the meeting, summarize the information, leave the farmer a copy and keep one.

Table 14. Participatory budget results for a plot of 400 m² (0.04 ha) shown in Naira (N) per plot.

Name of farmer		Catherine		Group	Catherine's group		Year	2003	
Village:		Ekumtak			Local Government Ogoja				
Crops in trial		Cassava only							
Imperata control method		Glyphosate only compared with *Mucuna*							
Field/plot size:		20m x 20m (0.04 ha)							
1 Outputs		**Glyphosate only**			**Mucuna only**				**Increase**
Crop	Units	Amount	Price (Naira)	Total		Amount	Price	Total	
Cassava	basins[1]	16	200	3200	Cassava	4	200	800	
					Mucuna seed (kg)	22	20	440	
Subtotal			***A***	***3200***	***Subtotal***			***1240***	***1960***
Crop residues									
Cassava stick	bundles	10	200	2000	Cassava sticks	1	200	200	
Subtotal			***B***	***2000***	***Subtotal***			***200***	***1800***
Total Output			**A+B**	**5200**				**1440**	**3760**

[1]Actual measured weights (kg) of 4 basins were 83, 83, 71, and 50, giving an average of 72 kg per basin.

2 Inputs	Units	Amount	Price	Total		Amount	Price	Total	Difference
Planting material									
Cassava sticks	Bundles	2	200	400	Cassava sticks	2	200	400	
Subtotal			***C***	***400***	***Subtotal***			***400***	***0***
Chemical application									
Glyphosate	Liters	0.25	1000	250					
Labor and tank hire	Tanks	1	50	50					
Subtotal			***D***	***300***	***Subtotal***				***300***
Use of Mucuna									
Seed cost	Kg				Seed cost	1	20	20	
Labor for planting	Days				Labor for planting	1	200	200	
Subtotal			***E***		***Subtotal***			***220***	***-220***
Labor		Days	Cost per day	Cost		Days	Cost per day	Cost	
Clearing		1	200	200	Clearing	1	200	200	
Planting		1	240	240	Planting	1	240	240	
Ist weeding		4	230	920	1st weeding	4	230	920	
2nd weeding		4	230	920	2nd weeding	Nil			
Slashing		3	230	690	Slashing	4	230	920	
Harvesting		1	200	200	Harvesting	1	200	200	
Subtotal			***F***	***2970***	***Subtotal***			***2280***	***690***
Total inputs			**C+D+E+F**	**3670**				**2900**	**770**
Outputs less inputs			**(A+B)-(C+D+E+F)**	**1530**				**-1460**	**2990**

An increase in yield of 12 basins of cassava provided an additional output valued at N1960. In addition, another N1800 worth of cassava sticks were available for sale or planting a new crop.

The cost of Glyphosate, tank hire, and labor for spraying, cost an additional N300, while seed cost and labor for planting Mucuna cost N220. Labor for land clearing, planting, weeding, slashing and harvesting the cassava cost N690 more for the Glyphosate treatment, the total additional input being N770. The main reason for the additional costs of the Glyphosate treatment being that one more weeding was undertaken.

The Glyphosate treatment in this case provided an additional output of N2990, made up of income less costs of N1530 for the Glyphosate treatment and a loss of N1460 for the Mucuna treatment.

A partial budget was also undertaken by farmers in the same group to compare use of Glyphosate with hand weeding even though farmers in this area had fully accepted that herbicide use was an appropriate technology for them (Table 15). Yield measurements were not made.

Although the chemical was applied at more than twice the recommended rate due to the *Imperata* being very tall when the chemical was applied and cost N300, the farmer saved N1070 by using the Glyphosate.

Table 15. Comparing the use of Glyphosate with hand weeding.

Name of farmer		Catherine		Group	Catherine's group		Year	2003	
Village:		Ekumtak			Local Government	Ogoja			
Crops in trial		Cassava only							
Imperata control method		Glyphosate only vs handweeding							
Field/plot size:		20m x 20m (0.04 ha)							
Inputs		**Use of Glyphosate only**				**Hand weeding**			
	Units	Amount	Price	Total		Amount	Price	Total	Difference
Chemical application									
Glyphosate	Liters	0.25	1000	250					
Spraying and tank hire	Tank	1	50	50					
Subtotal			***A***	***300***	***Subtotal***				***300***
Labor[1]									
1st weeding	Days	4	230	920	1st weeding	4	230	920	
2nd weeding		4	230	920	2nd weeding	4	230	920	
3rd weeding		Nil			3rd weeding	4	230	920	
4th weeding		Nil			4th weeding	4	230	920	
Slashing		3	230	690	Slashing	4	230	920	
Subtotal			***B***	***2530***	***Subtotal***			***4600***	***-2070***
Total			**A+B**	**2830**	**Total**			**4600**	**-1770**

[1]The daily wage rate is N200 with another N30 provided as food.

6 Further reading

Ashby, J., A. Braun, T. Gracia, M. del Pillar Guerrero, L.A. Hernandez, C.A. Quiros, and J. Roa. 2000. Investing in farmers as researchers. CIAT Publications NO. 318, Cali, Columbia. ISBN 958 694 030 6.

Chambers, R. 1993. Challenging the Professions: Frontiers for Rural Development. Intermediate Technology Publications, London, UK.

CIAT. 2004. Participatory research that crosses frontiers. Various publications. http://www.ciat.org./agren/africa

Chambers, R. 2002. Participatory workshops: a sourcebook of 21 sets of ideas and activities. Earthscan Publications.

Galpin, M., P. Dorward, and D. Shepherd. 2000. Participatory farm management methods for agricultural research and extension: a training manual. AERDD, University of Reading, UK.

Hagmann, J., E. Chuma, K. Murwira, and M. Connolly. 1998. Learning together through participatory extension: a guide to an approach, developed in Zimbabwe. Agritex, Harare, Zimbabwe.

Hagmann, J., E. Chuma, K. Murwira, and M. Connelly. 1999. Putting process into practice: operationalising participatory extension. *In* ODI Agricultural Research and Extension (AGREN) Network Paper No. 94. Overseas Development Institute, London. http://www.odi.org.uk/agren/papers/agrenpaper_94.pdf

Perret, S. and M. Mercoiret (eds.). 2003. Supporting small-scale farmers and rural organization: learning from experiences in West Africa. A handbook for development operators and local managers. Protea Book House, IFAS and CIRAD, Pretoria, South Africa.

PRGA. 1997. A global program on participatory research and gender analysis for technology development and organizational innovation. Agren Network paper No. 72 ODI, London, UK.

Van de Fliert, E. and A.R. Braun. 2001. Conceptualizing integrative farmer participatory research for sustainable agriculture: from opportunities to impact. Working document No 16. CGIAR system wide program on participatory research and gender analysis (PRGA).